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Patentanmeldung Nr. Patent application No. Demande de brevet n°

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Method to make a splice in a laid rope construction

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METHOD TO MAKE A SPLICE IN A LAID ROPE CONSTRUCTION

The invention is related to a method to make a splice in a laid rope construction comprising at least three strands and to a new splice based thereon. Splices are used amongst others in eye splices and end-for-end splices for e.g. ropes, grommets, hawsers and round slings. Splices are also used in the production of endless ropes.

A method to make a splice in a laid rope is known from "The Splicing Handbook of Barbara Merry, ISBN 0-07-135438-7. Herein a splice is made by splitting a rope in its single strands and tucking these single strands in another part of the rope in case of an eye splice, or in another rope in cases where two ropes are connected with each other. In the known method typically single strands are separately tucked in another rope or in another part of the same rope to make an eye.

A connection made with a known splice in a rope has a lower strength than the strength of the original rope. This means that the strength retention, hereinafter refered to as "efficiency" of the known splices, being the ratio of the strength of the splice and the strength of the original rope is below 100%.

The inventions aims to provide a method for making a splice in a laid rope construction with at least three strand ropes, with a higher efficiency than the known splice.

This aim is achieved in that:

a) one end of a first rope end is split in a first and a second part comprising respectively a first and a second number of strands, the first part having at most one more strands than the second part

b) the first part is tucked from one side in an opening in a second rope, such that the opening has a first number of strands on one side and a second number of strands on the other side, where the first and second number differ at most by one,

c) the second part is tucked from the other side in the opening in the second rope

d) step b) and c) are repeated at least 3, respectively 3+1 times, whereby the respective openings in the second rope are separated such that the first and the second part have crossed over at least all the strands of the second rope once and the first and second part leave the second rope at respective last openings.

With the method according to the invention it was surprisingly found that the efficiency is higher than the efficiency of the known splice.

The invention provides a method to make a splice in a laid rope construction, with at least three strands. Preferably the laid rope has 3, 4 or 6 strands.

In the method of the invention one end of a first rope is split in a first and a second part comprising respectively a first and a second number of strands, the first part having at most one more strands than the second part. This means that a 3-strand rope is split in a first part with 2 strands and a second part with only 1 strand. A 4-strand rope is split in two parts of 2 strands and a 6-strand rope in two parts of 3 strands.

In the method of the invention the first part is tucked from one side in an opening in a second rope, such that the opening has a first number of strands on one side and a second number of strands on the other side, where the first and second number differ at most by one. With a second rope in this application is not only meant a second rope as such, in case two ropes are connected with each other, but also another part of the first rope in case an eye is made. A second rope may also be the other end of the first rope in case a round sling is made. Generally the first and the second rope have the same number of strands.

When the first and second rope have 3 strands each, the said opening has 2 strands on one side and 1 strand on the other side. When the first and second rope has 4 or 6 strands the said opening has 2, respectively 3 strands on both sides.

In the method of the invention the second part is tucked from the other side in the opening in the second rope, which implies that both parts of the first rope are tucked in different directions through the opening in the second rope.

In the method of the invention step b) and c) are repeated at least 3 times, whereby the respective openings are separated such that the first and the second part have crossed over at least all the strands of the second rope once and the first and second part leave the second rope at respective last openings. The sequence wherein step b) and c) are repeated is of no importance for the efficiency of the resulting splice.

After at least 3 tucks for the first, and at least 3+1 tucks for the second part, the splice can be tapered. With at least 3+1 it is meant that the second part has at least one more tuck than the first part in order to avoid the tapering of the two parts to commence at the same place.

The tapering can be done by cutting off half or one third of the first and second part and continue the steps b) and c) for another three or four times. This process of tapering can be repeated until the last part of the first and second part are being cut off completely.

Preferably the splice is tapered by:

e) cutting off a complete strand from the first and the second part where they leave the last opening,

f) repeating step b) and c) for at least 3 times

g) repeating steps e) and f) until the last strand rope is being cut off.

The advantage of the method according to the invention is that it is easier to determine one half or one third in a part consisting of two respectively three strand ropes than to find half of or one third of the yarns in one strand rope.

The rope used in the method of the invention can be made from any material commonly used for yarns. Examples of materials used in ropes with at least three strands are polyester, nylon, polypropylene, aramids, polyethylene, and high molecular weight polyethylene.

An additional advantage of the preferred embodiment is, that with this method a splice is much faster to produce than with the known method. This advantage it particular relevant for ropes produces from highly drawn fibers of High Molecular weight linear polyethylene. Due to the low coefficient of friction a splice of at least 9 tucks is required to obtain a good efficiency. By using coated high molecular weight polyethylene the number of tucks required to obtain a good efficiency can be brought down to about 7. This high number of tucks combined with advantage of the faster production of the splice according to the invention with respect to the known splice, makes that the method of the invention is preferably used in a rope comprising high-drawn fibres of high-molecular weight linear polyethylene. High molecular weight here means a weight average molecular weight of at least 400,000 g/mol.

Linear polyethylene here means polyethylene having fewer than 1 side chain per 100 C atoms, preferably fewer than 1 side chain per 300 C atoms. The polyethylene may also contain up to 5 mol % of one or more other alkenes which are copolymerisable therewith, such as propylene, butene, pentene, 4-methylpentene, octene.

Preferably, use is made of polyethylene fibres consisting of polyethylene filaments prepared by a gel spinning process as described in for example GB-A-

2042414 and GB-A-2051667. This process essentially comprises the preparation of a solution of a polyolefin of high intrinsic viscosity, spinning the solution to filaments at a temperature above the dissolving temperature, cooling down the filaments below the gelling temperature so that gelling occurs and drawing the filaments before, during or after removal of the solvent.

The invention further relates to a splice obtained with the method of the invention, to the use of this splice and to make an eye in a rope as well as for end-for-end splices in ropes, grommets, hawsers or round slings.

The invention further relates to an endless rope comprising the splice of the invention.

The invention is further elucidated by the following examples.

The Examples and Comparative Experiments are carried out with a rope made of high-drawn fibres of high-molecular weight linear polyethylene (Dyneema^{R} SK75), 3 strands of a construction 3x24x1/1760 dTex, 39 g/m and a lay length of 62 mm.

The ropes were coated with a solution of LAGO (ex GOVI, Belgium) in water (1 part by weight LAGO to 2 parts by weight of water) such that after drying the rope comprises 16 wt % (relative to the weight of the rope) of the coating material The ropes with a length between the bollards of 210 cm were subjected to a pre-stress of 4000N and a tensile test was carried out on a 100 tons Zwick tensile tester with a speed of 150 mm/min.

Example I

An end-for-end splice was made in two ropes of the above mentioned construction with 6 tucks, tapered in 2 steps of 3 tucks (hereinafter referred to as a 6/2/3 splice) The time to make the splice according to the invention turned out to be 2 x 5 minutes. The tensile strength was 76,4 kN, which is an efficiency of 100 %.

Example II

A single roundsling was made with the rope of the above mentioned construction and a (8/3/3) splice according to the invention. The tensile strength was 2 x 74,8 kN, which corresponds to an efficiency of 98 %

Example III

A rope of the above-mentioned construction with two eye-splices (6/3/3/) and one end-for-end splice in the middle (8/3/3) was made with splices

according to the invention. The tensile strength of this construction turned out to be 74,5 kN, which corresponds with an efficiency of 97 %

Comparative Experiment A

An end-for end splice was made in two ropes of the above mentioned construction with 6 tucks, tapered in 2 steps of 3 tucks. The time to make this splice according to the state of the art, as described in "The Splicing Handbook of Barbara Merry, ISBN 0-07-135438-7 turned out to be 2 x 20 minutes. The tensile strength was 71,3 kN, which is a an efficiency of 93 %.

Comparative Experiment B

Example II was repeated with a splice with 8 tucks, tapered in 2 steps of 3 tucks, according to the state of the art mentioned in Comparative Example A. The strength of this splice was 71,4 kN, which corresponds with an efficiency of 93 %.

CLAIMS

1. Method to make a splice in a laid rope construction, comprising at least three strands characterized in that:

   a) one end of a first rope end is split in a first and a second part comprising respectively a first and a second number of strands, the first part having at most one more strands than the second part

   b) the first part is tucked from one side in an opening in a second rope, such that the opening has a first number of strands on one side and a second number of strands on the other side, where the first and second number differ at most by one,

   c) the second part is tucked from the other side in the opening in the second rope

   d) step b) and c) are repeated at least 3 respectively at least 3+1 times, whereby the respective openings in the second rope are separated such that the first and the second part have crossed over at least all the strands of the second rope once and the first and second part leave the second rope at respective last openings.

2. Method according to claim 1, wherein:

   e) a complete strand rope from the first and the second part are cut off where they leave the last opening,

   f) step b) and c) are repeated for ate least 3 times

   g) steps e) and f) are repeated until the last strand rope is being cut off.

3. Splice obtained with the method of claim 1.

4. Use of the splice of claim 3 to make an eye in a rope, and for end-for-end splices in ropes, grommets, hawsers or round slings.

5. Endless rope comprising the splice of claim 3.

ABSTRACT

The invention relates to a method to make a splice in a laid rope construction, comprising at least three strands wherein:

a) one end of a first rope end is split in a first and a second part comprising respectively a first and a second number of strands, the first part having at most one more strands than the second part

b) the first part is tucked from one side in an opening in a second rope, such that the opening has a first number of strands on one side and a second number of strands on the other side, where the first and second number differ at most by one,

c) the second part is tucked from the other side in the opening in the second rope

d) step b) and c) are repeated at least 3 respectively at least 3+1 times, whereby the respective openings in the second rope are separated such that the first and the second part have crossed over at least all the strands of the second rope once and the first and second part leave the second rope at respective last openings.

The invention further relates to the use of the new splice to make an eye in a rope, and for end-for-end splices in ropes, grommets, hawsers or round slings.

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